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A SUMMARY OF IMPACTS FROM HWA AND DROUGHT ON EASTERN HEMLOCKS IN NEW JERSEY

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September 1994

A cursory look at the relationship between **HWA population densities, rainfall averages and new growth estimates** was conducted using the New Jersey impact plot data and NOAA Climatological records. The impact data include results from 11 hemlock stands in northwestern New Jersey and the rainfall data was collected from 6 NOAA weather stations within this region. Both data sets cover a 4 year period between 1989-92.

The sample size for each observation varies as a result of either missing data or a particular event that occurred in the same stand in more than one year. In all cases if one variable (rainfall, NG or HWA) was lacking, that year's site data was excluded from the sample population. This was the case for 12 of the possible 44 data sets. Also, specific variables were used to drive each query. Consequently, if the data set for that site and year did not "fit" the criteria, it was not included as part of the sample population. Sample populations for each query ranged from n=5 to n=24.

For analysis purposes, each variable was put into 2 classes. Rainfall data was considered "normal" if either the average or above average annual rainfall occurred at a given site. If rainfall was less than average, it was considered "below normal". NOAA uses 50-100 year periods to determine average rainfall within a given area. Rainfall deficit during the growing season only, was also considered but it did not seem to affect the outcome. Only during the drought of 1991 did a rainfall deficit occur in all eleven stands.

HWA populations were considered not significant or "light" if densities were less than 30 adelgids/100 needles and significant or "heavy" if population densities exceeded this threshold. Although some data sets did not have any HWA, the New Jersey study has shown that any population density below the 30 adelgids/100 needle threshold has little if any effect on new growth.

New growth estimates were grouped as "normal" if the percentage of new growth was 30 percent or greater and "below normal" if new growth was below this threshold. This threshold was selected after reviewing the MFO HWA Impact data. Here, average new growth estimates from 292 hemlocks rated as healthy were found to range from 37-84 percent.

Using these parameters, the following observations were made:

- During any given year in which HWA populations were heavy, only **19%** of the stands had normal new growth (n=16)
- In any given year when HWA populations were either light or non-existent, **83%** of the stands had normal new growth (n=24)
- **53%** of the stands had below normal new growth during years of above average annual rainfall (n=19)
- **90%** of the stands had normal new growth during 1991 when annual rainfall was below average (n=10)
- Following the 1991 drought, **73%** of the stands had below normal new growth in 1992. This occurred in spite of above average rainfall in 1992. (n=11)
- Following the 1991 drought, **100%** of the stands that had heavy HWA populations in 1992 had below normal new growth (n=5)

From these observations, several conclusions seem apparent.

1) Heavy HWA populations are negatively correlated to new growth;

2) Droughty conditions appear to have the greatest impact on new growth during the year following the drought;

3) The combination of droughty conditions and heavy HWA populations have a major influence on a trees' ability to produce new growth.